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# TOWARDS CLIMATE RESILIENT AGRICULTURE

**NICRA NEWS** 

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#### INTRODUCTION

ational Innovations in Climate Resilient Agriculture (NICRA), was launched in 2011 to address the challenges of climate variability and climate change along with farmers need to adopt quickly increasing frequency of drought, flood and other extreme events by application of science and technology. Technology Demonstration Component (TDC) of NICRA offers great opportunity to work with farmers and apply such technology under field conditions with the background of current climate hostility. The emphasis has been capturing and improving the understanding on performance of technologies in different agro-ecologies and farming systems. This also facilitates quantification of various components of climate resiliency in different biophysical and socio-economic context. In this way NICRA-KVKs play an important role in preparing village level contingency crop planning and different climate resilient measurements.

**ICAR-Agricultural** Technology Application Research Institute Kolkata having nine KVKs where different activities under Technology Components Demonstration of National Innovations in Climate Resilient Agriculture (NICRA) programme in various modules are carried out. Climate change has become an important area of concern for India to ensure food and nutritional security for growing population. The impacts of climate change are global, but countries like India are more vulnerable in view of the high population depending on agriculture.

The project aims to enhance resilience of Indian agriculture to climate change and climate vulnerability through strategic research and technology

demonstration. The overall focus of technology demonstrations under NICRA is to enhance resilience of farms and the farming community to climate risks so as to ensure sustainability over a period of time. Thus the emphasis is on adaption to climate variability which entails appropriate response to contingency situations. Sustainability is the immediate goal in highly intensive production systems facing natural resource degradation. Therefore, the central objective of technology demonstrations in such regions is not on enhancing productivity but on interventions related to coping with vulnerability as well as improvement in natural resource use efficiency for sustaining the productivity gains.

Enhancing the adaptive capacity and building resilience of the farming communities is important in the context of climate variability and to cope with these extreme events effectively. As part of the Technology Demonstration Component (TDC) of NICRA, proven technologies are being demonstrated in climatically vulnerable districts of the country. The objective is to impart resilience under variable climates and consequently enhance the pace of adoption of these resilient technologies by stakeholders. On-farm participatory demonstrations were taken up in climatically vulnerable districts across the country through KVKs.

Enhancing resilience is the key to achieve sustainability in agriculture especially in the context of climate vulnerability. The NICRA village was selected based on vulnerability of agriculture to climatic variability. The multidisciplinary team of KVK analyzed the constraints related to climatic variability based on secondary weather data, resource situation, farming systems and agricultural yields in the past few years.



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"Global warming is not just the greatest environmental challenge facing our planet - it is one of our greatest challenges of any kind."- Barack Obama, U.S. President







# Ridge and Furrow Cultivation: A new hope for farmers

S ri Radhakanta Mali is an enthusiastic and progressive farmer of Bongheri village. He had 0.83 ha of low land, only fit for cultivation of long duration traditional paddy varieties like Morishal, in Kharif. In absence of fresh water, he could not cultivate during winter or summer. He could hardly meet the annual requirement of food grains



for his family through farming. After the "Aila" (Cyclone) in 2009, he was even ripped of this hope, as the entire land turned unfit for cultivation due to salinity. He turned into a regular labourer, moving in and out of the village in search of work. His family was unsecured at home.

After the launch of NICRA project Sri Mali was one of the leading farmers who wanted to adapt to the various KVK NIMPITH

climatic vulnerabilities, witnessed by the village. He wanted to explore the village resources, so that he doesn't need to go out of the village by risking the social security of his family.

He converted 0.13 ha of his lowland into broad Ridges and Furrows, under the project. The small piece of land is developed as a series of furrows (4 ft wide x 3 ft deep) alternating with ridges (4 ft wide x 3 ft deep). He started growing vegetables like tomato, okra and bottle gourd on the ridges. This modification helped him to save the vegetables from prolonged submergence in Monsoon season. The stored water in the furrow could be used as lifesaving irrigation during dry spell. Simultaneously, he used the stagnant water in the furrows to grow prawns and carps. The moisture retained in the land during winter season, which helped to take a second crop like beans and bitter gourd. In rest of the 0.7 ha land, he continued to grow paddy.

Later he excavated a small pond of 0.06 ha, by his own cost and started fishery. He is now using vermicompost, biofertilizers, biopesticides, straw mulching and many other eco-friendly technologies in his farm. He harvested 18 q bitter gourd worth Rs. 27000/- and 15 q okra worth Rs. 18000/- in Kharif and 34 q tomato worth Rs. 34000/- in Rabi season. He got 2 q fish worth Rs. 30000/- from



the pond and the furrows during monsoon. His gross earning was Rs. 1.09 lakh. He got Rs. 71000/- as net profit with BC ratio of 2.87.

Sri Radhakanta Mali is now a happy farmer as his land is well protected against prolonged water stagnation resulting from intensive precipitation in short time span as well as against dry spell in Monsoon season. The increased soil moisture retention capacity of the land is allowing him to take a second crop in winter. His experience is being used to motivate other farmers to involve in cultivation who were intended to migrate to other areas.

# KVK MALDA

#### Creation of WHS improves livelihood of marginal farmers of Malda District

efore introduction of NICRA project at Village(s) of Brozolaltola, Meherchandtola, Jairamtola and Mahendrandtola under Panchayat Dakshin of Chandipur, Manikchak Block of Malda District by Malda KVK, there which some submerged ponds which were mainly used for Capture fishery and little-bit of secondary irrigation for Rabi crops *i.e.* 48 ha land of total 255 ha cultivable land of that area. After renovation and/or desilting of four nos of ponds having size of 0.3 ha each, an amount of additional 4500 cu.m water in each ponds are stored for Scientific Composite fish Culture (which produce 3.75 t/ha fish) and for



"Climate change is destroying our path to sustainability. Ours is a world of looming challenges and increasingly limited resources. Sustainable development offers the best chance to adjust our course."- Ban Ki-Moon, Secretary-General, United Nations





additional 32 ha area of cultivation are brought under double cropping as summer crops. By renovating these ponds, cropping intensity was increased from 142% to 200%, as a result a some of Rs 51600/- was increased per ha by growing second crop and additional 1265 man-days were increased under natural resource management.





# Solid waste management through the composting





quality of the manure was very poor due to unscientific management. Further, farmers were not all aware about the recycling of rural farm waste, kitchen waste *etc.* for preparation of organic manure. Considering the above, Coochbehar Krishi Vigyan

## **KVK COOCHBEHAR**

Kendra initiated demonstration programme on preparation of compost through NADEP method and vermicompost using locally available organic sources like cowdung, farm/ kitchen waste and other locally available organic materials. Total 217 nos. of demonostration (NADEP, Heap



and Vermicompost) were carried out at different corners of the village. As a result use of organic manure was increased in the tune of 141 ton, improved the quality of organic manure and slowly mitigate global warming by increasing the carbon sequestration.

The technology of producing compost and also the low cost production technology has been well accepted by farmers as well as local bodies. Gram panchayet is now also promoting both technologies to the farmers of the village as well as neighbouring village.



#### Land manipulation and water harvesting through Broad Bed Furrow (BBF) System

he BBF system converts in waterlog areas to Broad Beds and Furrows in South Andaman District. Shri Sanjay Saha village-Badmash Pahad Block-Ferrargunj used this technology to extend his water harvesting area.The Broad bed width 5 m is utilized for cultivation

## KVK PORT BLAIR

of Vegetables round the year. The furrows of depth 1.5 m are utilized for rearing of fishes like *Singhi*,





Magur, Annabus and cultivation of deep water paddy. Inputs supplied

"Climate change is the greatest threat to humanity, perhaps ever. Global temperatures are rising at an unprecedented rate, causing drought and forest fires and impacting human health."- Cary Kennedy, American Statesman, Former Deputy Mayor Colorado





during the year include seedlings of vegetable system for the beds and fish fingerlings (Grass carps) for the furrows. A gross return of Rs 23,600/was observed against the gross cost of cultivation of Rs 7,300/- with a net profit of Rs 16,300 with the B:C ratio 3.23. Now he extended the BBF with an area of 0.5 ha.

## **KVK JHARSUGUDA**

# Increase in farm mechanization through NICRA custom hiring center

he NICRA project started in 2011 at Bhoimunda village of Jharsuguda district under Krishi Vigyan Kendra, Jharsuguda. Before advent of NICRA project, there was only two numbers of power tillers in the village. One custom hiring center was set up under NICRA project with a view to provide services of different implements in a optimal price which is lower than the market price. Ultimately the farmers hired different implements from custom hiring center for agricultural operations in time. Gradually the farmers came to know the advantage of mechanical operations in agriculture and they started to use different implements under custom hiring center at optimal



price. The farmers of Bhoimunda village then started purchasing power

KVK KALAHANDI

# tillers for agricultural purpose. In every year on an average 3 to 4 power



tillers were purchased by farmers and now the number reached to 19. This is the impact of custom hiring center in the village having total farm families of 117.

#### Cotton + Pigeon pea intercropping yielded a huge income of farmers of Kalahandi

alahandi is a tribal dominated district of Odisha and majority of the population depend on agriculture as it is primary source of livelihood. NICRA adopted village Pipalpada is situated at 50 km away from Bhawanipatna. Paddy is the only crop was grown during Kharif.



During a diagnostic visit the scientist encouraged the farmers to go for low value to high value crops and from high water requiring crops to low water requiring crops. Along with paddy in Kharif some pulses, cotton and vegetables can also be grown which has higher profitability and production potentiality that can play a big role in changing their livelihood



besides providing nutritional security. During 2015-16, Pigeon pea variety *Asha* was demonstrated in the farmer's field of that village as an intercrop with cotton var. *Shalimar*. Sri Balaram Mishra, one of the farmers of the village was maintaining livelihood from 8 acres of land. Due to traditional method of rice cultivation and poor crop productivity, he was not satisfied with the lower income. He used to cultivate only paddy both in the upland and low land. Sri Balaram Mishra, after consulting with the KVK Scientists, he was convinced to grow pigeon pea and cotton along with Kharif paddy. He has grown cotton in 8 acre of upland. Pigeon pea was intercropped with cotton during Kharif 2016-17.

Cotton was grown with Pigeon pea in rows as 8:2 ratios.Adoption of improved technologies like proper planning, layout, planting, INM, IPM, *etc.* in cotton cultivation. Marketing information gave him a great support to sell the harvested produce, which earned him maximum rates and fetches good profits. On time sowing of the seed and seed treatment with *Rhizobium* culture, Application of recommended dose of fertilizer, optimum care during critical growth stage of the crop, IPM and Weed

"We have to face the reality of climate change. It is arguably the biggest threat we are facing today."- William Hague, Former Secretary of State for foreign Affairs, UK





management, Increase in knowledge and exposure to new technologies for Pigeon pea. From 8 acres of cotton + pigeon pea intercropping he produced 85.2 q of seed cotton and 10.4 q of Pigeon pea. Overall he had spent Rs. 1,66,000 for cultivation and gross return was Rs. 4,03,400. His net profit was Rs. 2,37,400.

### **KVK SONEPUR**

# Ensuring livelihood security by pond based farming system

n Badmal village of Sonepur district farm ponds were excavated under NICRA programme which has



brought a ray of hope among the farmers by bringing a perceptible change in crop production. A complete waste land of a farmer named Sri Manoranjan Pardia has been changed into a crop land due to this farm pond which serves as a source of irrigation in both the cropping seasons. Before the NICRA intervention his only source of farm income was from rice cultivation in his low land during Kharif season. But now after excavation of the farm pond and taking technical advice



from KVK scientists his completely unproductive waste land is now converted into a mini horticultural

**KVK GANJAM** 

farm in which he has raised tomato and cauliflower during rabi season and now during this kharif he has gone for half acre lady's finger cultivation and in other half acre he has cultivated ridge gourd, cow pea and cucumber. Due to cultivation of these high value crops he has got enhanced yield with an additional income Rs. 1,00,000 per annum bringing an economic stability in his social life.



# *Climate resilient gram variety proved to be a boon*

disha is lying just south of the tropic of cancer, has a tropical climate. It is warm almost throughout the year with maximum temperature hovering between between 45-52°C and in winter it is intolerably cool. Moisture content of the soil was only 7%.

It was revealed that majority of the farmers was facing the problem of low productivity in gram due to several factors like non availability of heat tolerant varieties, imbalanced use to nutrients, moisture stress in growth stage and incidence of pests and diseases.

After farmers participatory planning

it was decided to demonstrate high yielding short duration varieties (*Prasad*) and having heat tolerant capacity (*TRAM-1*, to avoid YMV



incidence during high temperature) along with balance doses of nutrients.

Keeping this in view intervention was planned with *Prasad* and *TRAM-1* with foliar application of NPK (19:19:19) @ 10 g/L at 20 and 35 DAS. The average productivity was recorded to be 510 kg/ha (*Prasad*) and 480 kg/ha (*TRAM-1*). The normal return *i.e.* B:C ratio was found to be 1.84 under *Prasad* and *TRAM-1* against the existing farmers varities (B:C::1.75).

This brought a spectacular change in gram production scenario in Ganjam district







#### Improved sugarcane cultivation – A profitable farming practice in Kendrapara

Shri Kailash Behera, S/o-Late Yasobanta Behera 45 years, a native of Kasotibali which is



coming under Marshaghai block and 25 kms away from KVK, Kendrapara is a leading Sugarcane farmer in the village and the only earning member of his seven members family. He is regularly cultivating sugarcane in the same piece of land. He does not follow any crop rotation practice in his farm. Sri Behera started sugarcane cultivation on a commercial basis in his 3 acres of land. After repeated cultivation of sugarcane the yield was gradually declining due to heavy disease infestation. Then he took technical guidance from the KVK for proper measures and finally he obtained a good yield again. He cultivated 3 acres of land and got 105 tons of sugarcane per year. The income generated by him was Rs. 2,31,000 (Rs. 2,200 per ton), where 4.8 tons of seedlings were needed to cultivate his 3 acres of land, so total

# KVK KENDRAPARA

requirement Rs.10,156 (Rs. 2,200 per ton). The benefit was Rs. 2,20,844 per year.

It has been proved by the results obtained at the research stations and demonstrations conducted on farmers' fields that the intercropping with sugarcane is beneficial over the growing of sugarcane alone. Keeping the idea in view, a team of scientists of Krishi vigyan Kendra (KVK) thoroughly discussed the prospects of intercropping in sugarcane with the farmers. During the discussion,



it came to our notice that the farmers of the area have never taken intercrop with sugarcane. They were apprehensive of yield reduction in both sugarcane and intercrop due to less time available for intercultural operations. Generally, the farmers had been growing sugarcane during spring season or after the harvest of rabi crops *i.e.* March to May. Farmers felt surprised to know about the benefits of growing sugarcane in autumn season. Normally, there is no yield reduction in intercrops. The farmers thus got motivated towards

intercropping in autumn planted sugarcane. Sugarcane, not only increased the productivity per unit area and time, but also provided mid-season income which eased the burden on the already depleted income of the farmers and provided them with an option for better input management for remaining part of the sugarcane growing season. Neighboring farmers of the area were positively influenced by the results of the demonstrations and they themselves started convincing other farmers for adoption of the technology on larger areas. In order to overcome the above said short comings in the cultivation of sugarcane and also to bring more area under sugarcane cultivation, it is proposed to establish mechanized System of Sugarcane Intensification (SSI) centers by adopting the following:



- » To maintain 5 ft. distance between the rows.
- » Adopting proper seed treatment.
- » Convert in to mechanized planting.
- » Intercultivation with mini tractors and power weeders.

## REVIEW WORKSHOP OF NICRA-TDC OF ODISHA KVKS HELD AT ICAR-ATARI, KOLKATA ON JULY 12, 2017

one day NICRA workshop of Odisha KVKs was organized on July 12, 2017 in ICAR-ATARI, Kolkata. The workshop was chaired by Dr. S. S. Singh, Director, ICAR- ATARI, Kolkata and Dr. J V N S Prasad, Coordinator, NICRA-TDC, CRIDA, Hyderbad. The meeting was attended by Dr. S. K. Roy, Dr. A. Haldar, and Dr. K. S. Das, Principal Scientists, ICAR- ATARI, Kolkata and all the Programme Coordinators of NICRA implementing five KVKs of Odisha.

Dr. JVNS Prasad, Coordinator, NICRA-





TDC, CRIDA, Hyderbad mentioned in his presentation that each intervention should be planned in relation to the climatic vulnerability like drought, cyclone, salinity, heat stress, flood *etc*.

Dr. S. S. Singh, Director, ICAR-ATARI, Kolkata in his speech he mentioned the intervention under NICRA should read vulnerability with existing cropping practices and preventing this vulnerability through NICRA intervention is to be a priority. He emphasized to take up new interventions model which have direct bearing with the climate changes.

The following recommendations were come up during the deliberation

- 1. Vulnerability index should be measured and accordingly intervention to be executed.
- 2. Large scale dissemination of successful technologies to be undertaken.
- Farmers wise and intervention wise data to be provided by every KVK.

- 4. Performance of CHC and VCRMC need to be improved in Odisha KVKs.
- 5. Contingency planning may be prepared to respond in time.
- 6. Topography situation of village data (Up, Mid and Low land) should be kept in each NICRA village.
- Socio-economic impact of the successful technology demonstration should be analysed.
- 8. Intervention on livestock/fishery should be taken on proper climate resilient basis.
- Well performing NICRA KVKs exchange their knowledge with other NICRA KVKs.
- 10. Documentation of the successful intervention to be prepared.
- 11. Creation of water resources should be more in Odisha KVKs.
- 12. Crop diversification intervention need to be undertaken in more numbers in Odisha KVKs particularly.
- 13.Extension activities or training programme to be conducted on

climate related issues.

- 14. All the KVKs should prioritize their required equipments based on the budgetary provision.
- 15. The titles of the training under NICRA should be innovative with thrust on climate resilience.
- 16. Conducting impact evaluation of KVK by ATARI and other external agency.
- 17. Effective utilization of fund must be followed.
- 18. Emphasis must be given for convergence with different ongoing programmes in the district, particularly for KVKs of Odisha.
- 19. Demonstration of different units in KVK to showcase different technologies.
- 20. Identification of technologies according to land pattern must be followed.
- 21. Identify different climate resilient varieties and inclusion of those in the district plan in collaboration with district authority for horizontal spread.

## NICRA ZONAL MONITORING COMMITTEE OF ICAR-ATARI KOLKATA VISIT TO KVKS-KENDRAPARA AND JHARSUGUDA DURING OCT 31-NOV 1, 2017

he Zonal Monitoring Committee of NICRA -TDC of Zone V comprising Prof. H. K. Senapati, Former Dean PG-cum-DRI, OUAT, Bhubaneshwar as Chairman, Dr. S. S. Singh, Director ATARI Kolkata as Vice Chairman, Dr. Md. Osman, NICRA-TDC Coordinator as CRIDA Nominee, Dr. B. Maji, Principal Scientist - Former Head, ICAR-CSSRI, RRS, Canning Town as DDG (NRM) Nominee, Dr. P. K. Roul, Dean Extension Education, OUAT Bhubaneshwar and Dr. F. H. Rahman, Principal Scientist, ICAR-ATAR Kolkata as Member Secretary, visited Kendrapara and Jharsuguda KVKs and NICRA Project sites to get an overall view of the agro-climatic conditions of the ecosystem in the region during the period of October 31 to November 1, 2017. The committee interacted with KVKs personnel and reviewed the salient achievements of NICRA-TDC programme during last six years. Thereafter the committee moved to the NICRA village Dasmankul and interacted with VCRMC members and visited the different interventions implemented at the village. In the next day the committee moved to Jharsaguda KVK, visited KVK farms and interacted on major activities of NICRA-TDC programme implemented during last six years. The committee

also visited NICRA village, Bhoimunda and reviewed all the demonstration and interacted with the VCRMC members on the activities and impact of the programme.

The ZMC Team during their visits to the sites was accompanied by the project personnel. Following the presentation made initially at the KVKs for an overview of the problems and the activities undertaken indepth discussions took place with the farmers and VCRMC members at respective sites of both the KVKs. The salient intervention-wise recommendations emanating from





the discussion directly related to the project sites are as follows:

» Minimum 25 year database of rainfall and ET are required to work out probable availability of excess rainfall water for irrigation.

» For storing excess rainwater, structures may be developed, and for appropriate crop planning commensurate with the factors like climate, crop water requirement, soil properties, land configuration, water table status, and other relevant factors there are methods/ expertise



available in the country. Water may be stored for its utilization in various water harvesting structures like fresh ponds, re-excavated existing ponds, canals, etc.

» Low discharge- high frequency irrigation methods like drip, sprinkler and pitcher are ideal to increase water use efficiency and cover larger area under irrigation.

» The interventions on rainfed rice based cropping systems may be taken up as priority as rice is the major crop of the area.

» Paira/Utera cropping( relay cropping) are to be taken in paddy field for proper utilisation of residual moisture.

» The Cropping system such as ricecowpea, maize-cowpea, rice- arhar, rice-green gram may be followed for utilization of fallow land and residual moisture. » No further intervention on boron application in cauliflower may be practiced

» Crop diversification with suitable varietal substitution having drought tolerant capacity and short growing period should be taken up to combat the ill effects of climate.

» Introduction of inter cropping such as potato + maize, maize + groundnut, maize + moong during rabi in post flood areas.

» In case of INM in brinjal, inoculation of Azotobacter and Azosporillum may be considered.

» Finding out the amount of nitrogen fixation by green manuring in rice and other crops and then in accordance to that recommend the fertilizer to the farmers.



» Suitable industrial waste may be used to neutralize the acidity of soil.

» Use of bio- fertilizers may be encouraged in crop production.

» Raising of bund height in rice field may be encouraged along with residue incorporation for better restoration of soil moisture and organic carbon status. In addition, salinity problems will be reduced to a great extent in the project sites of Kendrapara.

» Focus should be given on urbanization of custom hiring centre efforts for inflow of fund from other organization to NICRA village and listing of good technologies. » Human resource development through women empowerment should be increased in NICRA adopted villages.

» Special focus to be given on selective breeding, upgradation of local breed, popularizing technologies that could minimize adverse effect on animal and fish components.

» VCRMC is advised to organize more awareness meetings among the famers for taking up the various interventions.

» The committee emphasized on the Convergence programme where both the KVKs need to take initiative for making convergence with ongoing projects in the respective district. Through this convergence KVK might generate good funding flow from other department.

» The Committee feels that the project site *i.e.* village Bhoimunda, Jharsaguda where the activities being carried out is not representing



the typical climate changing issues. Therefore, the committee recommends changing the site to other village considering accessible to the village and other suitable parameters.

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"The single most important thing we can do to protect our communities from climate change is to reduce dangerous carbon pollution."- Frances Beinecke, Former president of the Natural Resources Defense Council, US